AFOSR Special Announcement

BAA No. AFOSR 2005-4

AFOSR Opportunities in Information Science and Technology

OVERVIEW INFORMATION

1. **Agency Name:** Air Force Office of Scientific Research (AFOSR)
   875 North Randolph St, Suite 325, Room 3112
   Arlington, VA 22203-1768

2. **Program Name:** AFOSR Opportunities in Information Science & Technology

3. **Funding Opportunity Title:** AFOSR Opportunities in Information Science & Technology

4. **Funding Opportunity Number:** AFOSR BAA 2005-4

5. **Catalog of Federal Domestic Assistance (CFDA) Number:** 12.800

6. **CFDA Title:** Air Force Defense Research Sciences Program

7. **Dates:** Proposals will be accepted on a continuous basis during the fiscal year; but, to ensure prompt consideration for FY06 funding, researchers are encouraged to submit proposals to AFOSR by 2 December 2005.

8. **Executive Summary:** AFOSR announces a fiscal year 2005 competition for research in Information Science and Technology (IS&T), specifically basic research that advances network-enabled systems and the teams that employ them. The Air Force has always relied on technology to achieve and maintain air, space, and decision dominance through the simultaneous projection of superior force and expertise. Future capabilities rely on advancements in Information Science and Technology (IS&T) to provide greater interconnectivity and interoperability among sensors and operators, to enable the tight integration of operational planning/execution with targeted data collections, and to accelerate the usability of information.

The goal of this competition is to fund innovative, forward thinking research in team-driven, network-enabled IS&T within universities, industry, and the Air Force Research Laboratory. Targeted research areas break into four concentrations:

- Networks & Communications,
- Software & Security,
- Information Management & Process Integration, and
- Human-System Interactions.

FULL TEXT OF ANNOUNCEMENT

I. Funding Opportunity Description:

AFOSR announces a fiscal year 2005 competition for research in Information Science and Technology (IS&T), specifically basic research that advances network-enabled systems and the teams that employ them. The United States Air Force has always relied on technology to achieve and maintain air, space, and decision dominance through the simultaneous projection of superior force and expertise. Constant IS&T investment is needed to confront the security demands of an increasingly complex world and to cultivate the knowledge for new technologies and capabilities in the 21st Century. Future capabilities rely on advancements in Information Science and Technology to provide greater interconnectivity and interoperability among sensors and operators, to enable the tight integration of operational planning/execution with targeted data collections, and to accelerate the usability of information.

The goal of this competition is to fund innovative, forward thinking research in team-driven, network-enabled IS&T within universities, industry, and the Air Force Research Laboratory. Targeted research areas break into four concentrations: Networks & Communications, Software & Security, Information Management & Process Integration, and Human-System Interactions.

1. Networks & Communication:

In support of distributed networked operations, basic research is needed in decision theory, communication theory and design principles that enable large scale, dynamic networks. The next generation networks must support hundreds of thousands of personnel and devices and have rapidly reconfigurable heterogeneous architectures. Network traffic will include a wide variety of data types and tend to be bursty. Quality of Service (QoS) guarantees will be mission essential.

Potential topics include:

- Network-layer and transport-layer protocols for dynamic networks;
- Multiple Input Multiple Output (MIMO) enabled networks and protocols, compression, and other exploitation of channel characteristics;
- Sensor networks and their issues including real-time, embedded computing and power-aware compiling, processing, and allocation;
- Adaptation of high level network protocols to rapidly changing channel conditions; adaptation of parameters for dynamic bandwidth sharing;
- High level network protocol metrics to study the impact of link level characteristics on application performance;
- High performance ad hoc networks for bulk transfers with peer-to-peer devices as relays and related reconfiguration issues;
- Ultra wideband (UWB) as a system-level paradigm;
- Network architectures and protocols for the purpose of delivering time-critical control information, including the case where there is lost or missing information due to unreliable links;

- Mathematical and computational tools for modeling of network dynamics and for system-level optimization;
- Languages and tools for large-scale architectures and network management including policy-driven resource allocation;
- Algorithms, protocols, and metrics for Mobile Networking, 3-D vehicle routing and handoff.

Program Managers:
Dr Jon Sjogren, AFOSR/NM, 703-696-6564, jon.sjogren@afosr.af.mil
Maj Todd Combs, AFOSR/NM, 703-696-9548, todd.combs@afosr.af.mil

2. Software and Security:

More than 60% of the cost of AF systems is the cost of the software. Whether imbedded software in the many subsystems of a single system or middleware connecting many systems of systems, the problems are the same—large software-dependent systems are hard to verify and validate initially and even harder to V&V when evolved or integrated into bigger systems. Basic research is needed to develop tools to analyze the composability, evolvability, scalability, and security of large software intensive systems.
Potential topics include:

- Co-evolution of CONOPS and system architecture – early exercise-based use to understand requirements and test architecture;
- Security – assured levels of security during design (before coding and test);
- Composability – rapid component assembly;
- Evolvability – extensibility by users within predictable performance boundaries;
- Provable reliability with hard time deadlines;
- Methodological approaches for non-functional attribute analysis: trade-off analyses among scalable, survivable, and secure codes;
- Executable specification, software architecture research (reverse engineering);
- Software for easy verification and validation;
- Components/integration – model and compose design factors, components, and design tools;
- Scalability;
- Scalable solutions for building S/W engineering environments;
- Semantically defined high-level architecture;
- Life-cycle evolvability – ability to extend and evolve systems in the field;
- S/W elasticity – produce elasticity measure and extend functionality with predictive performance and support requirements.

Program Manager:
Dr Robert Herklotz, AFOSR/NM, (703)696-6565, robert.herklotz@afosr.af.mil

3. Information Management and Process Integration:

Military plans and operations benefit from heightened situational awareness and the real-time projection of expertise into and out of the battlefield. In future battle spaces, vast numbers of sensors and unmanned vehicles will be in simultaneous use, each with different sensing capabilities providing disparate views of the operations around, above, and below. Networked operations and extensive reach back capabilities will enable a paradigm shift from passive data

collections to active interrogation and instantaneous, synchronized exploitation of actionable information. Both the recognition and authoritative communication of actionable information requires tight integration of planning and collection processes so what is relevant and what is knowable can be readily negotiated.

Potential topics include:

- Multi-level, cross-domain representation of multi-modal signals (e.g. video, images, auditory, olfactory, hyperspectral) for efficient transmission, storage, manipulation, multi-modal data mining, machine learning, and cognitive processing;
- Query processing for large-scale sensor networks; trade offs ranking query functionality vs. limited power, bandwidth, and other concerns; coping with mobile sensors, vigilant sensors, unreliable sensors, and high data rates;
- Techniques that process/manage semi-structured content for data modeling, querying, routing, execution, and visualization; techniques that deconstruct the composition of discovered information and discern the intent of the author and target audience and the implied value of data as depicted in the composition;
- Mechanisms for learning, tracking, and managing networked teams (including theier relationships, behavior, community generation, group hierarchy, membership, common practices and metrics, and roles and responsibilities) through their use and customization of shared information spaces;
- Fusion and querying of new, incomplete, uncertain, and/or contradictory data; metrics quantifying the value added by new information, processes, and modalities;
- Mechanisms for determining the relevance and certainty of queries and assertions and for determining the quality of the processes that produce them; modeling of query sources and assertion sources with the information and metrics each contribute and require; peer review strategies among overlapping, multi-modal information management systems;
- Deep information extraction and information forensics—respectively, assigning meaning and consequences to information.

Program Manager:

Maj Amy Magnus, AFOSR/NM, (703)696-8431, amy.magnus@afosr.af.mil

4. Human-System Interactions:

Human management, control, and use of networked information systems are central to their design and effectiveness. For example, network quality of service is often measured in human terms; information management and fusion enhance human decision making; and software composability and evolution take advantage of human decisions about worthwhile system design goals and approaches to implementation. In addition, objects and processes from which information is gathered are often under human control and sometimes under adversarial control that increases the difficulty of adaptive and predictive modeling. This topic addresses the need for augmented human capability produced via training and hybrid systems and the formal models (computational and mathematical) for analyses in all phases of operation: anticipate, observe & orient, decide, and act.

Potential topics include:

- Anticipate & Act
  - Learning theory-based techniques for predictive and prescriptive modeling;
  - Modeling and simulation test beds for basic research relevant to analysis and training application, as well as the simulation of networked individuals, groups, and organizations
  - Methods for determining both optimal performance and best human performance levels for decision making in dynamic, networked information systems; metrics for evaluating performance effectiveness and readiness relative to a theoretically maximal level of human performance;
  - Simulation of urban and human environments including behavioral models of non-cooperative individuals, groups, and organizations.
  - Quantitative approaches for establishing the effectiveness of human decision makers' models and for estimating the confidence levels associated with predictions of future decision making;
  - Methods for anticipating the effects of individual differences in ability, knowledge, culture, and other factors on decision making over a network.
- Observe & Orient
  - User navigation of systems involving complex and noisy data, decision systems;
  - Combination of heuristic and optimization techniques for complex searches with adaptability to different levels of detail to avoid information overload of the warfighter;
  - Implications of power usage in sensors and displays vs. range of visual items, human attention, and control; fundamental requirements and metrics in designing, implementing, and experimenting with complex interactive time-critical information systems;
  - Enhanced interactive mixed-modality models/experiments/test-beds for more integrated real-time human/system/sensor and database decision support relevant to Air Force goals.
  - Models for dynamically quantifying human situational awareness/understanding in complex environments.
- Decide
  - Automated diagnosis and decision support, automated learning;
  - Tools for improved human interactions with automated reasoning and inference systems under constraints;
  - Decision support techniques for addressing partial-solution approximations based on evolving, non-static information—e.g., combinations of Bayesian inference models and heuristics;
  - Formal analysis and representation of situations, for explaining and augmenting human decision making.

Program Manager:

Dr John Tangney, AFOSR/NL, (703)696-6563, john.tangney@afosr.af.mil

II. Award Information:
AFOSR intends to award research grants and contracts for this effort. Awards will be modeled after the standard project grant or the Partnerships for Research Excellence and Transition (PRET) program. The PRET program is a university-based research program of excellence involving strong industrial ties to accelerate the transition of research results to industry. Collaborations among academia and with government agencies and industry are encouraged.

The Government reserves the right to select for award all, some, or none of the proposals received. Subject to the availability of funds and seletion of adequate proposals, AFOSR anticipates multiple awards will be funded for an initial performance period of twelve months maximum (The initial POP must end on or before 30 Nov 2006.) with two additional twelve-month options. Awards for grants average $150K per year, and awards for PRET collaborations will likely not exceed $1M per year. Negotiations may reduce funding of the awards to an amount lower than that proposed. Target date for award(s) is 1 February 2006 although some awards may be made in December 2005 and January 2006.

III. Eligibility Information

1. Eligibility: This requirement is full and open. Institutions of higher education should have degree granting programs in science, mathematics and/or engineering. Proposals are encouraged from historically Black colleges and universities and minority institutions (HBCU/MI), as defined by 10 U.S.C. 2323. No funds are specifically allocated for HBCU/MI participation.

2. Cost Sharing: None

3. Other: None

IV. Application and Submission Information

1. White papers: White papers, no more than 10 pages for grants and 20 pages for PRETs, are desired (but not required). White papers submitted by the target date 7 October 2005 will receive a response by 21 October 2005.

2. Address to Request Application Package: For an application package, consult the AFOSR web page: www.afosr.af.mil. Directly under the AFOSR logo centered on the home page is "Doing Business with AFOSR". The first listing under this topic is "How to Apply for a Grant or Contract" (http://www.afosr.af.mil/oppts/afrprop.htm); full details of proposal content and form are provided on this page. Download and complete the proposal Cover Page (http://www.afosr.af.mil/docs/afrgcvr.doc or http://www.afosr.af.mil/docs/afrgcvr.htm). In the block "Title of Proposed Project", add the following: Solicitation Title: AFOSR Opportunities in Information Science & Technology.

If internet access is not available, paper copies may be requested by contacting info@afosr.af.mil or by sending a self addressed label with your request to: AFOSR/PIC; 875 North Randolph St, Suite 325, Room 3112; Arlington, VA 22203-1768.

3. Content and Form of Application Submission: Grant proposals of more than 25 total pages, including cover page and budget, are discouraged as are PRET proposals of more than 50 pages. Per the application package, it is strongly encouraged to provide all required documents listed below, as well as supporting justification and calculations.

- Cover Page
- Abstract
- Statement of Objectives
- Technical Proposal
- Key Personnel
- Cost Proposal
- Certifications and Representations
- Documentation to Support Eligibility
- Categorical Exclusion CATEX (Environment)

If applicable, also include:

- Human Subject Use
- Use of Laboratory Animals (DOD Directive 3216.1)

4. Submission Date and Time

Proposals will be accepted on a continuous basis, but to receive prompt consideration for FY06 funds, proposals should be received at AFOSR by 2 December 2005. Only hard copy submissions will be accepted. Mail original and nine copies of the proposal to:

Air Force Office of Scientific Research
ATTN: Maj Amy Magnus (NM), Opportunities in Information Science & Technology
875 North Randolph St, Suite 325, Room 3112
Arlington, VA 22203-1768.

Target dates are summarized below:

Event	Date	Comments
White Paper Received by AFOSR	Friday, 7 October 2005	White papers are desired but not required
White Paper Comments back to Submitters	Friday, 21 October 2005	
Proposals Received by AFOSR	Friday, 2 December 2005	AFOSR must receive ten hardcopies; submissions will be accepted
Announcement	Monday, 2 January 2006	Tentative
Target Award(s) Date	Wednesday, 1 February 2006	Anticipated

5. Intergovernmental Review: None

6. Funding Restrictions: None

V. Application Review Information

1. Criteria: The proposals will be evaluated by a team of specialists drawn from AFRL, AFIT, and the science education community. Proposals will be evaluated using the following criteria. The first three factors are of equal importance to each other. The last factors are of lesser importance than the first three, but are of equal importance to each other.

a. The scientific and technical merits of the proposed research.
b. The potential contributions of the proposed research to the mission of the Air Force;
c. (PRETs only) The proposed interaction between university and industry for the purpose of transition the generated information;
d. The proposer's key personnel qualifications, capabilities, related experience, facilities, or techniques, or a combination of these factors that are integral to achieving Air Force objectives;
e. The proposer's and associated personnel's record of past performance;
f. The reasonableness and realism of proposed cost and availability of funds. Although not a primary evaluation factor, price is a substantial factor in the selection of proposals for award.

Due to the emphasis on networked operations, the technical evaluation will value efforts that can analyze and represent the contribution and risks of the proposed technology and designs to the host network and its collaborative environment.

VI. Award Administration Information:

1. Award Notices: The Principal Investigator of the successful proposal will receive a notice, by letter or email. For the proposal being recommended for an award, the notification should not be regarded as an authorization to commit or expend funds (except at the recipient's own risk, to the extent that the recipient allows charging to awards of 90 days pre-award costs). Negotiations may result in funding levels that are less than proposed. Only an award document signed by a Government Grants Officer will bind the Government.

2. Administration Requirements: Title to equipment purchased under this program will be vested with the institution without further obligation to the government. AFOSR's terms and conditions for grants are available at the AFOSR web page www.afosr.af.mil. Click on "Doing Business with AFOSR" directly under the centered AFOSR logo center left on the home page.

3. Reporting: Performance reports will be due to AFOSR annually and a final technical report will be due after completion of the research. For report content see www.afosr.af.mil/pdfs/performancereportsMarch2000.pdf. Financial Report using SF-269 (or SF-272) is required by Part 32 of the DoD Grant and Agreement Regulations (32 CFR part 32)

VII. Agency Contracts:

Address questions to Maj Amy Magnus at Amy.Magnus@afosr.af.mil.
Mailing address: Air Force Office of Scientific Research
ATTN: Maj Amy Magnus - NM
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